U.S. FISH AND WILDLIFE SERVICE SPECIES ASSESSMENT AND LISTING PRIORITY ASSIGNMENT FORM

Scientific Name:

Brachyramphus brevirostris

Common Name:

Kittlitz's murrelet

Lead region:

Region 7 (Alaska Region)

Information current as of:

06/01/2011

Status/Action

___ Funding provided for a proposed rule. Assessment not updated.

___ Species Assessment - determined species did not meet the definition of the endangered or threatened under the Act and, therefore, was not elevated to the Candidate status.

___ New Candidate

_X_ Continuing Candidate

___ Candidate Removal

___ Taxon is more abundant or widespread than previously believed or not subject

___ Taxon not subject to the degree of threats sufficient to warrant issuance of

___ Range is no longer a U.S. territory

___ Insufficient information exists on biological vulnerability and threats to su

___ Taxon mistakenly included in past notice of review

___ Taxon does not meet the definition of "species"

___ Taxon believed to be extinct

___ Conservation efforts have removed or reduced threats

Petition Information

___ Non-Petitioned

_X_ Petitioned - Date petition received: 05/11/2001

90-Day Positive:05/04/2004

12 Month Positive:10/26/2011

Did the Petition request a reclassification? **No**

For Petitioned Candidate species:

Is the listing warranted(if yes, see summary threats below) **Yes**

To Date, has publication of the proposal to list been precluded by other higher priority listing? **Yes**

Explanation of why precluded:

Higher priority listing actions, including court-approved settlements, court-ordered and statutory deadlines for petition findings and listing determinations, emergency listing determinations, and responses to litigation, continue to preclude the proposed and final listing rules for this species. We continue to monitor populations and will change its status or implement an emergency listing if necessary. The Progress on Revising the Lists section of the current CNOR (http://endangered.fws.gov/) provides information on listing actions taken during the last 12 months.

Historical States/Territories/Countries of Occurrence:

- **States/US Territories**: Alaska
- **US Counties**:County information not available
- **Countries**: Russia

Current States/Counties/Territories/Countries of Occurrence:

- **States/US Territories**: Alaska
- **US Counties**: Aleutians East, AK, Aleutians West, AK, Anchorage, AK, Bethel, AK, Bristol Bay, AK, Denali, AK, Dillingham, AK, Fairbanks North Star, AK, Kenai Peninsula, AK, Kodiak Island, AK, Lake and Peninsula, AK, Matanuska - Susitna, AK, Nome, AK, North Slope, AK, Northwest Arctic, AK, Southeast Fairbanks, AK, Valdez - Cordova, AK, Wade Hampton, AK, Yukon - Koyukuk, AK
- **Countries**: Russia

Land Ownership:

Offshore, Kittlitz’s murrelets occur primarily in Alaska State waters (0-3 nautical miles (nm) from shore), and within the U.S. Exclusive Economic Zone (3-200 nm from shore). Onshore, this species is found on lands managed by the U.S. Forest Service, U.S. Fish and Wildlife Service (Service), National Park Service, the State of Alaska, Native lands, and Department of Defense lands. The proportion of the population nesting on each of these land ownerships is unknown.

Lead Region Contact:

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Lead Field Office Contact:

Biological Information

Species Description:

Species Description/Taxonomy
Kittlitz's murrelet (Brachyramphus brevirostris; Vigors 1829) is a member of Alcidae or Auk family. Brachyramphus murrelets are unusual because unlike the rest of this diverse family of seabirds which typically nest in colonies, they nest solitarily. There are two additional species within the Brachyramphus genus, the marbled murrelet (B. marmoratus marmoratus) and the long-billed murrelet (B. m. perdix) (Friesen et al. 1996a, p. 360). The distribution of marbled murrelet and Kittlitz's murrelet overlaps in Alaska and the distribution of the long-billed murrelet overlaps with the Kittlitz's murrelet in portions of Russia (Friesen et al. 1996b, p. 682). They are all generally similar in appearance but physical and genetic differences between them are well documented (Pitocchelli et al. 1995, pp. 239–248; Friesen et al. 1996a, pp. 363–365; Friesen et al. 1996b, pp. 681, 685–687; Day et al. 1999, p. 2). Kittlitz's murrelets are heavier, and have larger heads, longer wings and tails, and smaller bills than marbled murrelets (Pitocchelli et al. 1995, pp. 241–245; Kuletz et al. 2008, pp. 91–95). Long-bill murrelets are distinctly larger, have a longer bill, and a white eye ring (Friesen et al. 1996b, p. 681).

Mitochondrial DNA (mtDNA) sequences and restriction fragment analysis show significant differentiation among the three species (Pitocchelli et al. 1995, pp. 244–247; Friesen et al. 1996a, pp. 364–366; Friesen et al. 1996b, pp. 683–687). Analysis of allozymes further strengthens the evidence that these murrelets are separate species (Friesen et al. 1996a, pp. 361–365). Pacheco et al. (2002, pp. 179–180) used nuclear introns and cytochrome b gene sequencing and found no evidence of recent hybridization between marbled and Kittlitz's murrelets.

Kittlitz's murrelets have been considered a single panmictic population; however, recent data suggest there may be significant differentiation among geographically separated populations (MacKinnon 2005, pp. 18, 24–25). Intra-specific analyses of genetic data (allozymes, cytochrome b gene, and control region of mtDNA) suggest very low rates of immigration and emigration between Kittlitz's murrelets in the western Aleutian Islands and mainland birds from Kachemak Bay on the Kenai Peninsula (Friesen et al. 1996b, p. 686; MacKinnon 2005, pp. 18, 24–25). A study incorporating a larger sample size than previous studies and employing analyses of both mtDNA and nuclear genes suggests intraspecific genetic variation may be at a level that justifies management as evolutionarily significant units (MacKinnon 2005, p. 26). There have been no genetic analyses comparing Kittlitz's murrelets from Russia with those from North America. Although recognizing that there may be limited genetic exchange among populations, until further genetic testing is done with larger sample sizes range-wide, including intermediate areas between widely separated populations, the U.S. Fish and Wildlife Service (Service) will continue to consider Kittlitz's murrelet as a single panmictic population.

Taxonomy:

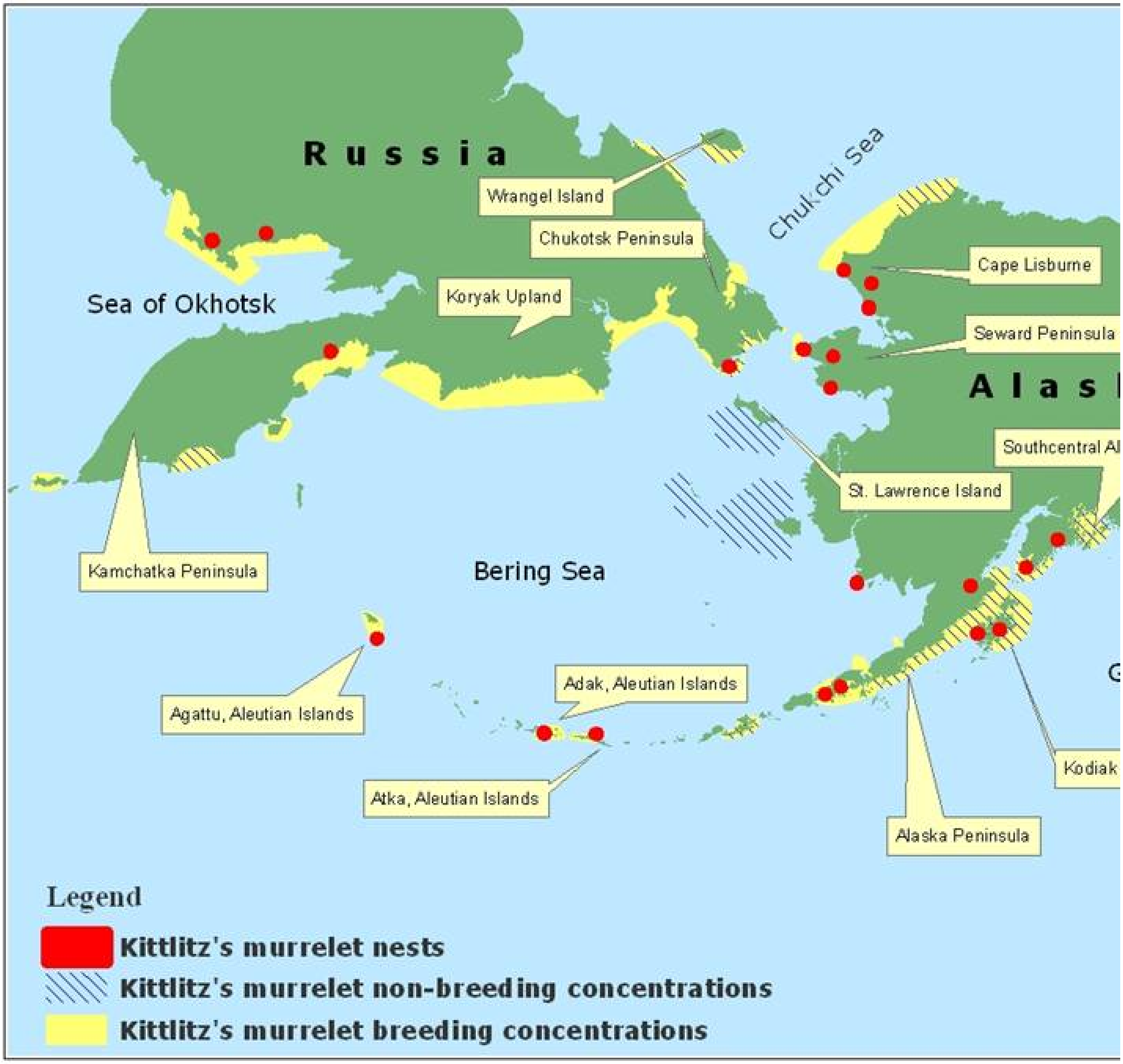
See species description

Habitat/Life History:

The seasonal appearance and disappearance of Kittlitz's murrelets during systematic surveys (Klosiewski and Laing 1994, pp. 55, 83; Kendall and Agler 1998, p. 55; Robards et al. 2003, pp. 92, 100, 104; Kissling et al. 2007a, pp. 2167–2168; Day et al. in press), and limited satellite tag data (Piatt et al. in litt., 2010), indicate that Kittlitz's murrelets move into glacially influenced marine waters in south central and southeast Alaska beginning in April, and leave these areas in late July to early August for wintering habitat that may be located in the Bering Sea (Day et al. 1999, p. 3; 2010; Kissling et al. 2007, pp. 2167–2168; Kuletz and Lang 2010, pp. 39–43; Day et al. in press). However, records of winter sightings in southeast, south central, and western Alaska, (Kendall and Agler 1998, pp. 55–56; Klosiewski and Laing 1994, p. 83; Day et al. 1999, pp. 4–5; Stenhouse et al. 2008, p. 61), indicate some individuals are year around residents in these areas. When it occurs, the shift between summer and winter distribution, appears to be rapid, and asynchronous among areas (Day et al. 1999, p. 7). Annual movements of Kittlitz's murrelets in Russia, the Aleutians, and northern Alaska remain poorly known.

Likewise, the winter range of the Kittlitz's murrelet is poorly known (Day et al. 1999, pp. 4–5). Recent information indicates that leads and polynyas (an area of open water surrounded by sea ice) southwest of St. Lawrence Island, as well as east of the Pribilof Islands and southeast of St. Matthew Island may be important wintering areas (Kuletz and Lang 2010, pp. 40–43). Winter range of the species outside Alaska is largely unknown, but observations have been reported from the Kamchatka Peninsula and the Kuril Islands in the Russian Far East (Flint et al. 1984). A few birds have been observed during late winter in the Sireniki polynya of southern Chukotka in Russia (Konyukhov et al. 1998, p. 325).

Figure.1. Distribution of Kittlitz's murrelets at sea and approximate nest locations.



During the summer breeding season, Kittlitz's murrelets are often associated with glacially influenced waters in southeast and south central Alaska, and relatively large numbers aggregate in these areas (Isleib and Kessel 1973, p. 100; Kendall and Agler 1998, p. 58; Day et al. 2003, pp. 693–694; Kuletz et al. 2003a, pp. 133, 136–138; Stephensen 2009, p. 28; Arimitsu 2009, p. 36; Kissling et. al, in press). The reasons for this association are not known with certainty. Piatt et al. (1999, p. 12) suggest that this pattern of distribution reflects an adaptation for nesting on recently deglaciated talus slopes, which are selected because these areas are predator-free. Their association with tidewater glaciers has also been linked to foraging preference and ability in these areas (Day et al. 2003, pp. 681, 686; Kuletz et al. 2003, p. 138; Arimitsu 2009, pp. 46–48). Nest area fidelity may also keep the birds returning to the same area (Piatt et al. 1999, p. 11; Kaler et al. 2010, p. 1). However, the species nests throughout its range during the summer breeding season and is not only associated with marine waters currently affected by glaciers.

Foraging

Because little research on Kittlitz's murrelets has occurred during the winter, information about foraging and other life history characteristics are based primarily on observations made during the spring, summer, and fall. In Prince William Sound and Glacier Bay, Kittlitz's murrelets tend to forage as single birds or in small groups (Day and Nigro 2000, p. 10). They seldom forage in mixed-species feeding flocks (Day and Nigro 2000, pp. 8-9, 12). Kittlitz's murrelets obtain prey by pursuing them underwater (Day et al. 1999, p. 9; Day and Nigro 2000, p. 9). During the breeding season, Kittlitz's murrelets feed on schooling fishes such as Pacific capelin (Mallotus villosus), Pacific sand lance (Ammodytes hexapterus), juvenile Pacific herring (Clupea pallasi), and juvenile walleye pollock (Theragra chalcogramma) (Day et al. 1999, p. 9; Day and Nigro 2000, pp. 11–13; Kissling et al. 2007b, p. 8; Lawonn et al. 2011, p. 18; Kaler et al. 2011, p. 15). Parents carry a single fish at a time to their chick. Pelagic (open water) schooling species such as sand lance and herring are thought to be favored and particularly important during the breeding season because of their high lipid, and therefore, energy content (van Pelt et al. 1997, p. 1395; Litzow et al. 2004, p. 1150). Chicks receive more calories and grow faster (Ostrand et al. 2004, p. 69), and theoretically adults would need to make fewer foraging trips when high energy fish are provisioned to chicks compared to lower energy fish such as walleye pollock or rockfish (Sebastes spp.). For this reason, a change in the availability of high energy forage could affect the reproductive success of Kittlitz's murrelet (van Pelt et al. 1997, p. 1393; Anderson and Piatt 1999, p. 117; Becker et al. 2007, pp. 276–278; Österblom et al. 2008, pp. 967–974). It is not known to what extent Kittlitz's murrelets distribution in a given year depends on prey availability. However, annual variability in Kittlitz's murrelet population density at a location may be due, at least in part, to annual variability in prey abundance.

Although they are considered a piscivorous species, Hobson et al. (1994, p. 795) found that euphausiids (krill, a shrimp-like crustacean) contributed approximately 44 percent to the Kittlitz's murrelet diet. Because the availability of high-energy forage is annually and seasonally variable (Agler et al. 1999, p. 102; Anderson and Piatt 1999, p. 117; Robards et al. 2003, p. 2; Litzow et al. 2004, p. 1149; Arimitsu 2009, pp. 33–36, 45), Kittlitz's murrelets likely switch among prey types between seasons or years depending on availability, as do marbled murrelets (Ostrand et al. 2004, p. 73; Becker et al. 2007, p. 274). Using stable isotopes Hatch et al. (in prep.) found that Kittlitz's murrelets foraged primarily on zooplankton during pre-breeding, and zooplankton plus fish during the breeding period. Post-breeding, murrelet tissues were highly enriched in nitrogen, suggesting a post-breeding dispersal from summering areas and consumption of high trophic level forage fish. Based on stable isotopes from museum specimens, these seasonal patterns have been consistent over the past century (1911-2009) (Hatch et al. in prep.).

Nesting

Because Kittlitz's murrelet nests are isolated and widely dispersed in remote, rugged areas, in a landscape sparsely populated by humans, they were infrequently encountered, historically. Up until 1999, only 19 confirmed Kittlitz's murrelet nests had been described, 17 in Alaska and 2 in Russia (Piatt et al. 1999, p. 8). In 2005, a nest was discovered on Agattu Island, in the Aleutian chain (Kaler 2006, p. 3). Since that time, an additional 65 active nests have been found and monitored on Agattu (Kaler et al. 2011, p. 19), 34 nests have been found on Kodiak Island (Lawonn et al. 2011, p. 13), and 10 in the glaciated landscape around Icy Bay (Kissling, in litt., 2011), greatly adding to our knowledge about the nesting and breeding behavior of this species. Nesting habitat in Alaska and Russia is sparsely vegetated or unvegetated scree-fields, coastal cliffs, barren ground, rock ledges, and talus above timberline in coastal mountains, generally in the vicinity of glaciers, cirques near glaciers, or recently glaciated areas (Day et al. 1983, pp. 267–269; Day 1995, pp. 271–273; Konyukhov 1998, p. 322; Piatt et al. 1999, p. 8; Kaler et al. 2009, p. 366). Local climate, geomorphology, aspect, substrate, unobstructed view of the ocean, and elevation may be important parameters determining nest site suitability (Day, 1995, p. 272; Piatt et al. 2009, pp. 13–14; Kaler et al. 2009, p. 366; Lawonn, 2009, pp. 16–17, Appendix C; Kaler et al. 2011, p. 8).

Similar to marbled murrelet, the cryptic, mottled plumage of the adults and chicks camouflages them from predators at the nest site (Nelson and Hamer 1995a, p. 66; Kaler and Kenny 2008, p. 1; Kaler et al. 2009, p. 367; Kaler et al. 2011, p. 1). There is evidence of nest area fidelity (Kaler et al. 2010, p. 1), and occasional nest site fidelity (Piatt et al. 1999, p. 11; Kaler et al. 2010, p. 1). However, it is unknown if the same birds are using a particular area annually or if site characteristics make the area suitable to breeding pairs. A single egg is laid on bare or nearly bare ground, at the base of a large rock (Piatt et al. 1994, p. 55; Piatt et al. 1999, p. 11; Day 1995, pp. 271–273; Kaler et al. 2009, p. 366). The egg is colored pale-green, olive-green, and blue-green with brown mottling, ranging from speckling to streaking (Day et al. 1983, pp. 265–266; Piatt et al. 1994, p. 55; Kaler et al. 2009, p. 367). Egg laying is asynchronous, beginning approximately 18 May through 15 July (Day 1996, p. 435; Kissling et al. 2007b, p. 5; Kaler et al. 2009, pp. 366–367; Kaler et al. 2011, p. 12; Lawonn et al. 2011, p. 14), and there is evidence that Kittlitz's murrelets attempt to renest when a nest fails (Kaler and Kenney 2008, p. 16; M. Kissling, Service, 2010, pers. comm.). Based on the marbled murrelet, duration of incubation is approximately 30 days (Day et al. 1999, p. 14; Kaler et al. 2009, p. 365). Both parents incubate the egg, and loss of a parent can mean loss of the egg (Kissling et al. 2007b, p. 5). Mean hatch date on Agattu Island has ranged from 5 July to 22 July (Kaler and Kenney 2008, p. 9; Kaler et al. 2009, p. 366; Kaler et al. 2011, p.12). Like the marbled murrelet, Kittlitz's murrelet chicks are semiprecocial and are brooded for approximately 48 hours (Nelson and Hamer 1995a, p. 66). This requires that thermoregulatory capability is developed quickly after hatching so that the chick can remain unattended and have minimal parental care. Most likely this is another behavioral response to predation, minimizing the activity and flights to and from the nest by the adults (Nelson and Hamer 1995a, p. 66).

The chick is fed fish for 24 to 30 days post-hatch (Day et al. 1999, p. 15; Kaler et al. 2011, p. 15) at a rate of 1-13 times/day (Kissling, Service, 2007-2008, unpublished data; Kaler et al. 2011, p.15; Lawonn et al. 2011, p. 18). Both adults feed the chick throughout the day (Kissling, Service, 2007, unpublished data; Kaler et al. 2011, p. 16) or night (Day et al. 1999, p. 15). Similar to marbled murrelet, Kittlitz's murrelet chicks maintain their camouflaging down until just prior to fledging (Nelson and Hamer 1995a, p. 60; Kaler et al. 2009, p. 367). When they fledge, chicks are 40 to 60 percent of adult body mass, but their wing length is nearly adult size (Day et al. 1983, p. 272; Kaler et al. 2009, pp. 368–369; Lawonn et al. 2011, p. 19). Their initial flight is from the nest to the ocean can be relatively short from island nests (Kaler et al. 2009, p. 371; Lawonn et al. 2009, p. 14), or much longer from mainland nests, which have been documented as far as 75 kilometers (km) (46 miles (mi)) from the ocean (Day et al. 1983, p. 272). There is the possibility that fledglings fly downslope to the nearest river from an inland site and use the river as transportation to the ocean (Day et al. 1983, p. 272).

Most alcids nest in inaccessible areas (burrows, crevices) to hide from predators, while others nest in the open on rock ledges and protect their young by nesting in large colonies or by guarding them (Nelson and Hamer 1995a, p. 66). The risk of predation may be the most significant factor in the development of murrelet behavior (Nelson and Hamer 1995a, p. 66). Kittlitz's murrelet eggs and chicks are vulnerable in their open nest sites for approximately 60 days. Therefore, selection of safe nest sites and secretive behaviors to avoid detection are necessary for survival. On mainland habitats in south central and southeast Alaska, nunataks (mountain tops surrounded by glacial ice but not covered by ice) may be particularly favorable habitat because of their isolation from terrestrial predators. In addition to site selection, murrelets have a variety of morphological and behavioral characteristics as defense mechanisms to minimize detection (summarized by Nelson and Hamer 1995a, p. 66).

Although demographic data are sparse, Kittlitz's murrelets, like other alcids, exhibit the characteristics of a K-selected species in that they are relatively long-lived (approximately 15 years) and have low rates of reproduction (De Santo and Nelson 1995, pp. 36–37; Bessinger 1995, p. 385; Begon et al. 1996, pp. 494–496). This reproductive strategy depends on the survival of at least a few offspring and recruitment of those offspring into the adult population. Increased mortality of breeding adults generally has greater population–level effects in long-lived species with delayed maturity and low rates of reproduction (Beissinger 1995, p. 390; Österblom et al. 2008, p. 967). Low reproductive success has been suggested (Day and Nigro 2004, pp. 91–94) and documented in Kittlitz's murrelets (Kissling 2011 in litt.; Kaler et al. 2011, p. 18, Lowann et al. 2010, pp. 11–12). Because nesting behavior and success have been monitored for relatively few years (since 2006), it is unclear if the low success rate reflects the normal, or typical success rate for this K-selected species in which a breeding pair only needs to successfully produce offspring infrequently, or if one or more environmental parameters have changed, causing increased egg and chick mortality. Continued monitoring of reproductive success will be critical to our understanding of the status of this species. Nest observations from the three locations where nests are being monitored are summarized below.

Aleutian Islands - Since 2005, more Kittlitz's murrelet nests (66) have been found on the mountainous scree slopes of Agattu Island than in any other location (Kaler 2006, p. 3; Kaler et al. 2011, p. 19). From these 66 nests, 8 chicks successfully fledged (Kaler 2011, in litt.) and the fate of one chick was unknown, as researchers left the island before its fate was determined. In this time frame, 9 eggs did not hatch and 15 eggs were depredated. Of the 42 nests in which chicks were hatched, 3 chicks were depredated, and 29 died of exposure and/or starvation, and one died when it was blown out its nest by the wind. This research has shown that 70 to 75 percent of the nests failed because of the chicks dying from exposure/starvation (Kaler et al. 2011, p. 17). Kaler et al. (2011, p. 17) could not definitively assign the causes of chick mortality to either exposure or starvation; the high rate of chick mortality was likely due to multiple factors including diet, weather, and provisioning rates by adults (Kaler et al. 2011, p. 17). Although this rate appears very high, without any baseline data with which to compare it to, it is not possible to determine whether this rate is abnormally high. Fledglings at Agattu were approximately 50 percent of the adult body mass (Kaler et al. 2009, pp. 368, 370–371). This is less than has been calculated for marbled murrelets (65 percent) and for Kittlitz's murrelets that fledged from Kodiak Island at 60 to 80 percent of adult body mass (Lawonn 2009, p. 19; Lawonn et al. 2011, p. 19). Whether the low fledgling weight was due to the quantity or quality (lipid content) of prey delivered is unknown, because in most cases, it was difficult to identify the species of fish being delivered to the chick.

South central Alaska - Since the first nest was found on Kodiak Island in southcentral Alaska in 2006 (Stenhouse et al. 2008, p. 59), 34 additional nests have been found in an intensive nesting study (Burkett and Piatt 2008, pp. 1–3; Lawonn et al. 2011, p. 13). From 2008 to 2010 on Kodiak Island 5 chicks have fledged from 34 nests. In 2010, 3 eggs and 3 chicks were depredated, 3 eggs were not viable, 3 chicks died (all at age 5 days old or less), and 4 chicks fledged (Lowann et al. 2011, pp. 15–16). Depredation by red foxes (Vulpes vulpes), was documented in some instances through camera recordings. Chicks also died from apparent asphyxiation on a fish (1), accidentally being ejected from the nest (1), and exposure (1) (Lowann et al. 2011, p. 16).

Southeast Alaska – In Icy Bay 10 nests have been located since 2007 (Kissling, 2011, in litt). Nests in this area have been detected through the use of radio tags on birds, not from ground searching as has been done on the islands; the fewer nests detected does not indicate that fewer nests occur in this area. Because some nests were inaccessible, fledgling success in some cases was determined by the behavior of tagged adult birds instead of camera monitoring of the nest. The results of the camera monitoring and adult behavior indicate that 5 chicks fledged from the 10 nests (Kissling, 2011, in litt). Causes of nest failure included egg inviability, loss of a parent during incubation, predation, and accidental ejection from the nest. In 2007-2008 triglyceride and/or vitellogenin levels were measured in female Kittlitz's murrelets captured in Icy Bay as a means to measure fecundity. About 90 percent of female Kittlitz's murrelets captured had elevated triglyceride and/or vitellogenin levels (M. Kissling, Service, 2010, unpublished data); however, only about 10 percent of the adult birds that were captured nested (Kissling et al. 2010a, p. 16). This is an interesting and puzzling finding. It may suggest that although birds arrive at their breeding area ready to reproduce, certain environmental cues may be required for breeding to proceed. Another possibility is that elevated triglyceride and/or vitellogenin levels may not be a good indicator of breeding propensity in Kittlitz's murrelets. The birds arrive in Icy Bay in good condition, so why breeding propensity is so low is not easily explained (Kissling, 2011, pers. com.). Although it is unlikely that all females would attempt to nest in a given year (Beissinger 1995, p. 389), this rate seems unusually low.

Essentially nothing is known about juvenile survival and recruitment. Identification of juvenile Kittlitz's murrelets at sea is difficult, as their plumage variations are not well documented. Distinguishing between juvenile and adult Kittlitz's murrelets is especially difficult at the end of August when adults begin molting (Kuletz et al. 2008, p. 34). This complication could potentially influence the ability to estimate juvenile distribution and abundance at sea, which is one method used to determine reproductive success (Beissinger 1995, pp. 391–392). Day and Nigro (2004, pp. 91–93) suggest that reproductive success in Kittlitz's murrelets may be very low based on the near absence of juvenile birds in late summer surveys in Prince William Sound. Juvenile to after-hatch (subadults plus adults) ratios of approximately 10 to 30 percent were recorded in Kachemak Bay from 2004 to 2007 (Kuletz et al. 2008, pp. 59, 85) indicating either that nesting was occurring nearby or that juveniles were dispersing to that area. Ratios above 10 percent are high compared to what has been reported for marbled murrelet (Beissinger 1995, pp. 388–389) and may be in part due to the fact that Kittlitz's murrelet adults exited Kachemak Bay before the juveniles, boosting the ratio. To provide perspective, the total number of juveniles recorded in the 4 years of surveys was 37 (Kuletz et al. 2008, pp. 104–107). In 3 years of survey work conducted in the fjords of Prince William Sound (1996-1998), only a single hatch-year bird was sighted (Day and Nigro 1999, p. 32). Juvenile Kittlitz's murrelets have been observed in low numbers around Kodiak and Afognak Islands during the breeding season (Stenhouse et al. 2008, pp. 65–66). Four juvenile Kittlitz's murrelets (three newly-fledged and one roughly 2 to 3 weeks post-fledgling (all had their egg-tooth)) were radio-tagged in 2008-2009 in Icy Bay (M. Kissling, Service, 2010 unpublished data). The three newly-fledged birds were located within Icy Bay for approximately 24 hours before departing and not being detected again. The older fledgling, which was significantly heavier than the newly-fledged birds, was tracked in Icy Bay for 2-3 weeks until mid-August.

Historical Range/Distribution:

Current Range Distribution:

Range

The Kittlitz's murrelet occupies a vast area from the Russian Far East across to the Aleutian Islands and from southeast Alaska to northwest Alaska. Nests have been documented throughout their range (Figure 1). Annual shifts in distribution are discussed below.

Population Estimates/Status:

Status and Trend

Estimating abundance for most alcids is relatively easy compared to Kittlitz's murrelet because the majority of alcids are colonial nesters and surveys can be conducted at the nesting colonies where the birds are concentrated. In contrast, the solitary, isolated, remote, and secretive nesting behavior of the Kittlitz's murrelet, makes terrestrial monitoring impractical for the purposes of estimating abundance (Drew and Piatt 2008, p. 179). Even marbled murrelets, which are also solitary nesters, are easier to monitor because they are more abundant, they are more vocal (van Pelt et al. 1999, p. 397), and standardized methods for terrestrial surveys have been developed (e.g. Patton et al. 1990, pp. 4–8; Burger 2001, p. 696). Estimating distribution and abundance of Kittlitz's murrelets has relied entirely on at-sea surveys (Piatt et al. 2005, p. 3), which present several challenges.

A handful of ornithological surveys occurred in the waters surrounding Alaska up until 1972 (Isleib and Kessel 1973, p. 1). Beginning in 1972, systematic at-sea surveys for sea birds began in some locations (Klosiewski and Laing 1994, p. 5). Since that time, many surveys covering a wider geographic area have been conducted (e.g., Service 2010, Table 1). Unfortunately, it is difficult to draw firm conclusions about the range-wide abundance and trend of Kittlitz's murrelets from these surveys for the following reasons: 1) different survey methods were used across locations and often at the same location; 2) the time of year the surveys were conducted has varied; 3) the level of expertise and training in bird identification has varied among surveyors; 4) because Kittlitz's murrelets are difficult to distinguish from marbled murrelets, some data are inconclusive or a large number of unidentified birds were recorded leading to difficulties in analyzing data from certain sites or collection dates; 5) variable oceanic and climatic conditions affect surveyors' ability to see and identify Kittlitz's murrelets; 6) many surveys were designed to document all sea birds and mammals and were not specific to Kittlitz's murrelets; 7) the range of Kittlitz's murrelets is large and many areas of their range are not yet represented or are under-represented by surveys; 8) Kittlitz's murrelets are highly mobile, so birds may be moving in or out of a survey location during a survey; 9) during the incubation season when surveys are often done, an unknown proportion of birds is not counted; 10) counts across the range are not synchronized; 11) the birds have a clumped distribution; 12) there is typically a wide variance associated with population estimates; and 13) there is no standardized survey methodology accepted by all researchers and several methods are being used concurrently. However, because Kittlitz's murrelet researchers are aware of these problems and are trying to address them, survey methodology and consistency continues to improve, which will improve our ability to detect localized population trend over time. The size of Kittlitz's murrelet range (Figure 1), and the lack of good historical baseline data in many areas will continue to pose challenges in determining range-wide population estimates. An evaluation of past surveys and reliability of data is currently being conducted (State of Alaska, in litt., 2010, p. 3). In addition, a special symposium was held at the Pacific Seabird Group in 2010 on the "Population status and trends of Kittlitz's Murrelets" (http://www.pacificseabirdgroup.org/index.php?f=meeting&t=Annual%20Meeting&s, viewed May 10, 2011). The symposium proceedings are still under peer review and will be published in Marine Orinthology. The Service refrains from providing a range-wide population estimate this year while these projects are being completed.

The challenges related to surveys presented above also affect our ability to accurately assess trend. There are however, indications that the population size is lower now than it was when it was first surveyed in the early 1970s. In examining the effect of the Exxon Valdez oil spill on marine bird populations in Prince William Sound, Klosiewski and Laing (1994, p. 28) determined that there had been a decline in marine bird populations, including Brachyramphus murrelets before the spill occurred. Additional studies of marine birds in the region occupied by Kittlitz's murrelet have also documented significant declines most likely related to changes in the prey base (forage fish) (Hatch et al. 1993, p. 140; Piatt and Anderson 1996, pp. 729, 732; Agler et al. 1999, p. 101; Anderson and Piatt 1999, pp. 120–122; Litzow et al. 2002, p. 293; Kitaysky et al. 2006, p. 445). In total, these studies lend support to the observation that the Kittlitz's murrelet population has declined. However, because we do not have reliable population estimates across their range, the Service is unable to determine the magnitude of that decline. In 1973, Isleib and Kessel (p. 100) characterized Kittlitz's murrelets in the northern Gulf of Alaska (North Gulf Coast – Prince William Sound area) as a common resident. Researchers since the 1990s have consistently characterized it as "rare" (e.g., Piatt et al. 1994, p. 54; Kendall and Agler 1998, p. 53; Kissling et al. 2007, p. 2164; Drew and Piatt 2008, p. 178; Gall and Day 2009, p. 1, Kuletz et al. in press (a,b)). At this point, this is perhaps our best indicator that there has been a general decline in the species. Whether the population has stabilized is currently being evaluated but will require several more years of monitoring to determine.

Threats

A. The present or threatened destruction, modification, or curtailment of its habitat or range:

Climate change

In southeast, south central Alaska, and the south side of the Alaska Peninsula, Kittlitz's murrelets exhibit an association with glacially-influenced marine habitat (Kendall and Agler 1998, p. 55; Kuletz et al. 2003a, p. 133; Robards et al. 2003; van Pelt and Piatt 2003, p. 9; Arimitsu, 2009, p. 36; Kuletz in press (a), Figures 2 and 3). As mentioned earlier, the reason for this association is not clear. Their preference for areas near tidewater glaciers may be related to the diversity and abundance of energy-rich forage fishes such as Pacific capelin and Pacific sand lance (Robards et al. 2003, p. 71; Arimitsu et al. 2008, p. 137). However, Kittlitz's murrelets nest throughout their range (Figure 1) and tidewater glaciers are absent in the majority of their range. Consequently, although glacially-influenced waters may create forage-rich conditions in the summer, we cannot conclude that glacially-influenced waters are a required element of breeding habitat. How primary and secondary productivity or bathymetry in these glacial bays may be affected over time is impossible to predict and will most likely be site-specific. The oceanographic conditions in Glacier Bay provide an example of how complex these systems are, how difficult it is to predict how environmental parameters will change with time (Hooge and Hooge 2002), and how those changes will affect Kittlitz's murrelet distribution (Kirchhoff and Lindell, in prep.).

It has also been suggested that Kittlitz's murrelets are found near glaciers because they nest on recently deglaciated talus slopes (Piatt et al. 1999, p. 12). These remote, barren, unproductive areas are likely selected because terrestrial predators are largely absent. Nelson and Hamer (1995a, p. 66) argue that for the closely related marbled murrelet and most likely for Kittlitz's murrelet, strategies to avoid predation determine much of their nesting behavior, including nest site selection. The observation that Kittlitz's murrelets are found feeding near glacially-influenced marine waters in southeast, and south central Alaska, and the south side of the Alaska Peninsula may be primarily because the birds are selecting nest sites in recently deglaciated areas. That these waters are also productive is beneficial, but may not be the primary driver for the observation that Kittlitz's murrelets are concentrated in these areas.

The landscape of southeast, and south central Alaska and the south side of the Alaska Peninsula is changing relatively rapidly in response to climate change. The recession of glaciers and isostatic rebound (uplift in ground released from the weight of glaciers) are particularly notable (Field 1947, pp. 369–399; Hinzman et al. 2005, pp. 269–274; Larsen et al., 2005; p. 548). For example, Icy Bay did not exist at the beginning of the twentieth century because the bay was filled with ice (Meigs et al. 2006, p. 208). Likewise the size of Glacier Bay has increased and the size and shape of the glaciers have changed dramatically over the last 100 years (Field 1947, pp. 369–399; Fastie 1995, p. 1900; USGS 2011 http://www.usgs.gov/global_change/glaciers/repeat_photography.asp, viewed April 19). Kittlitz's murrelets have adjusted their distribution in response to these changes in habitat availability as well, loafing and foraging extensively within the relatively recently created bays. In the short term, as glaciers continue to retreat, additional barren, isolated habitat is expected to be created that will be suitable for nesting for Kittlitz's murrelets. Over the long term, plant succession (Fastie 1995) and distance to water are expected to decrease the amount of suitable habitat available. As plants colonize the landscape, the habitat becomes unsuitable for nesting, predators become more abundant, and areas such as nunataks, which were once isolated from predators, become accessible through vegetated corridors. Distance from suitable nesting habitat to marine foraging habitat is expected to increase over time as tidewater glaciers recede away from the water and terrestrial glaciers continue to recede inland. While Kittltiz's murrlet nests have been found at great distances from marine waters (Day 1999, p. 13), the greater the distance the nest is from foraging habitat, the greater the amount of energy required to provision the chick, the longer the exposure time to predators, and the greater the distance the chick must fly on its initial flight to the sea. All of these factors would be expected to lower the probability of survival.

We anticipate that glacial recession and loss will continue into the future. Loss of glacial volume is a phenomenon occurring on a global scale (Dyurgerov and Meier 2000, p. 1410; Lemke et al. 2007 pp. 356–359). Although glacial retreat has been occurring since the end of the Little Ice Age (around 1850), during recent decades, glaciers are melting at rates that cannot be explained by historical trends only (Dyurgerov and Meier 2000, p. 1406). Glaciers respond to change in climate almost immediately and are particularly sensitive to air temperature (Dyurgerov and Meier 2000, p. 1410; Hock 2003, pp. 104–105; Hall and Fagre 2003, pp. 135, 138). Increases for average surface air warming at the end of the century range from approximately 4 degrees C to 7 degrees C relative to the average recorded from 1981 to 2000 (Hassol 2004, pp. 26–28; ACIA 2005, p. 4). Even with an average temperature rise less than 1 degree C, glaciers will continue to retreat in the next century (Oerlemans et al. 1998, p. 270; Hall and Fagre 2003, p. 138). It is expected that climate change over the next century will continue to melt glaciers (Hall and Fagre 2003, pp. 137–139).

Climate warming and associated glacial and sea ice melt may be delivering increasingly contaminated melt water to receiving water bodies. This phenomenon has been studied most extensively in alpine freshwater catchments in Europe where organochlorines, polycholorinated biphenyls (PCBs), the pesticide dichlorodiphenyl trichloroethane (DDT) and its metabolites (DDTs) were elevated in lakes receiving glacial melt (Bogdal et al. 2009, pp. 8173–8176; Schmid et al. 2011, pp. 205–207). In Alberta, Canada, a substantial percentage of current glacial melt originates from ice that was deposited in 1950 through 1970, when organochlorines were more concentrated in the atmosphere than they are now, or were before 1950 and the concentrations of persistent organic pollutants were, on average, 29 times higher in a glacial stream, relative to a nearby non-glacial valley stream (Blais et al. 2001, pp. 410, 414–415). The above studies were conducted in alpine freshwater lake systems, which may not be directly comparable to physical and chemical processes associated with coastal marine systems and tide-water glaciers. In a study of a polar coastal environment in Antarctica, a marine sediment core was collected, dated, and analyzed for a ubiquitous radionuclide contaminant (cesium-137) associated with historic nuclear weapons testing (Sanders et al. 2010; pp. 422-423). Cesium 137 exhibited an abrupt concentration increase in recent sediments relative to older sediments. While results are limited to a single sediment core (so extrapolation should be conducted with caution), the authors hypothesize that increased snow/ice melt from the uplands and enhanced sediment transport have resulted in net movement of cesium-137 from the coast into the marine environment. We are unaware of relevant contaminant studies from coastal ice fields or alpine glaciers in Alaska; therefore it is difficult to evaluate the significance of this potential source of contamination for Kittlitz's murrelet. However, given this species' close association with glaciated and recently deglaciated habitats in some portions of its range, this contaminants exposure pathway deserves further study.

Changes in the marine environment as a consequence of climate change play a significant role in the population regulation of phytoplankton, zooplankton, and fish, and can disturb the balance in predator-prey relationships (Hunt et al. 2002, p. 5823; Hunt and Stabeno 2002, pp. 15–19; Grebmeier et al. 2006, pp. 1461–1463; Aydin and Mueter 2007, pp. 2509–2521). In marine ecosystems, local conditions are generally influenced by large-scale processes (Becker et al. 2007, p. 268). As ocean temperatures change, forage fish abundance changes (Hunt et al. 2002, pp. 5835–5842; Abookire and Piatt 2005, pp. 236–238; Becker et al. 2007; pp. 267–269). The southeastern Bering Sea shelf, (Stabeno et al. 2007, p. 2616), Bering Sea, and southern Chukchi Sea surface sea temperatures have been warming, in particular since 2000 (Steele et al. 2008, pp. 1–5). A shift to a warm water regime in 1977 in the Gulf of Alaska resulted in more than a 90 percent decline in capelin, one of the primary prey items of Kittlitz's murrelet (Anderson and Piatt 1999, p. 120; Day et al. 1999, p. 9). Becker et al. (2007, p. 277) suggest that a progressively warmer marine environment that could be induced by climate change may cause a 'semi-permanent' warm phase. Because this change would affect prey availability, they hypothesize that marbled murrelet reproductive success would be reduced (Becker et al. 2007, p. 277). Because marbled murrelet and Kittlitz's murrelet diets are very similar, a similar conclusion may hold true for the Kittlitz's murrelet.

In summary, climate change is affecting the habitat of Kittlitz's murrelets. Although we can hypothesize about the various mechanisms by which Kittlitz's murrelets can be affected by these changes, we have not identified a causal link that is currently causing a population-level effect. Of the mechanisms listed above, changes in the marine environment have been documented, changes in the distribution of fishes have been documented, and changes in piscivorous bird populations have been documented. Because widespread oceanic changes have been documented, it is more likely that changes in this arena could have a population-level effect, in particular the availability of high quality forage fish during the breeding season. Consequently, this mechanism could be responsible for a general population decline. However, these changes can also be caused by regime shifts (discussed below). Likewise, the release of contaminants from melting ice is of concern because this could affect forage both in their winter and summer habitat, and inviable eggs have been documented. Loss of tidewater glaciers through climate change is not currently identified as a threat to the population because no causal link to population decline has been identified. It may be possible that food quantity and/or quality is higher in glacially influenced waters, leading to higher nest success; but at this time we do not have evidence to support this hypothesis. Changes in forage quality, quantity, or distribution within glacially influenced bays cannot be predicted at this time and is not considered a threat. Loss of nesting habitat will likely be offset by gains in the short term. Over the long term (50-100 years) there may be a loss of nesting habitat in one part of their range (southeast, south central Alaska) as coastal landscapes become more vegetated and the distance from nesting and foraging habitat increases. We conclude that although climate change is modifying the habitat of Kittlitz's murrelet, we cannot conclude that this modification is leading to an effect on the population.

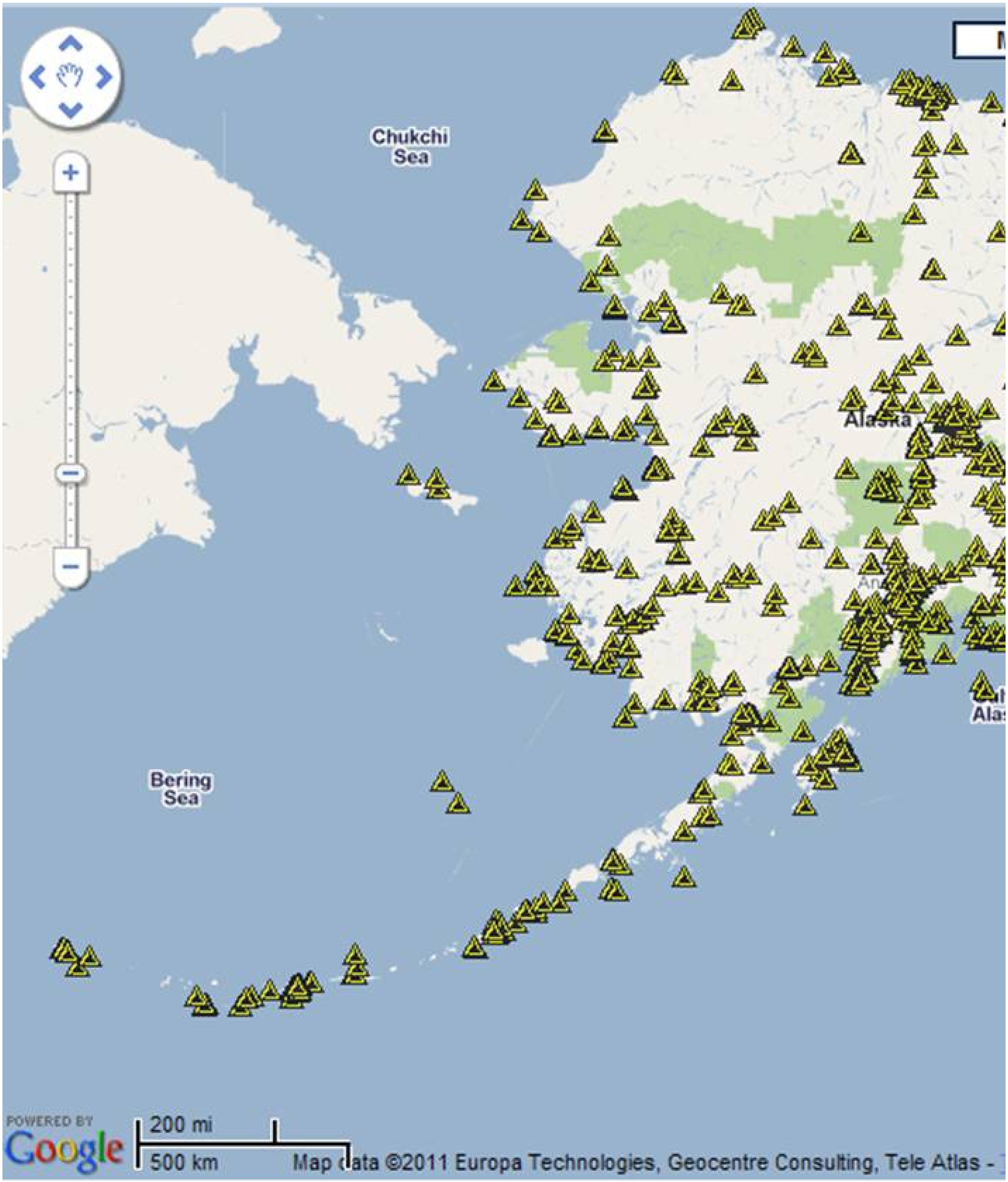
Regime shift

A shift to a warm water regime shift occurred in 1976-1977 and is hypothesized as being partially responsible for the decline in Kittlitz's murrelets (van Vleit 1993, p. 15; Agler et al. 1999, p. 100). Other piscivorous marine bird species in the Gulf of Alaska have declined over the past few decades (Hatch et al. 1993, p. 140; Piatt and Anderson 1996, p. 723; Agler et al. 1999, p. 100; Litzow et al. 2002, p. 286), apparently influenced by widespread changes in ocean climate and forage fish abundance (Piatt and Anderson 1996, pp. 727–730; Anderson and Piatt 1999, pp. 120-122; Hare and Mantua 2000, pp. 128–140; Litzow et al. 2002, p. 286). Klosiewski and Laing (1994, pp. 22–23, 28) Piatt and Anderson (1996, p. 732), and Agler et al. (1999, pp. 100-102) documented large declines in a number of bird species in Prince William Sound between 1972 and 1989-1991 that could not be attributed to the Exxon Valdez oil spill alone, indicating that other environmental factors were affecting sea birds before the spill occurred. Marbled murrelets, which may have a high degree of dietary overlap with Kittlitz's murrelets (Day and Nigro 2000, p. 11; Day et al. 2003, p. 681), have also declined in some areas (Piatt et al. 2007, pp. 47–49, 211–248; McKnight et al. 2008, p. 29; Kuletz et al. in press a), lending support to the hypothesis that broad ecological changes have affected Kittlitz's murrelets. Teasing apart changes in the ocean ecosystems that are caused by decadal scale shifts (e.g., Pacific Decadal Oscillation, Northern Oscillation Index, Arctic Oscillation) verses changes caused by climate change will likely become increasingly challenging.

Environmental contaminants

Local, regional and global sources of environmental pollution exist within the Kittlitz's murrelet range. One potential source of environmental contaminants, melt-water from glaciers, is discussed above. The Alaska Department of Environmental Conservation (ADEC) maintains a database of known sites within the State: http://www.dec.state.ak.us/spar/csp/db_search.htm. The distribution of sites can be visualized using an ADEC mapping tool which graphically depicts the approximate location of these sites (http://www.dec.state.ak.us/spar/csp/web-map/index.htm#) (Figure 2). There is a high degree of overlap with the Kittliz's murrelet range in Alaska (Figures 1 and 2).

Figure 2. Distribution of contamination sites in Alaska.



Several studies have investigated contaminants in seabirds or their eggs in Alaska (e.g., Vander Pol et al. 2004; Rocque and Winker 2004, Burger et al. 2007; Ricca et al. 2008, Vander Pol et al. 2009); however, Kittlitz's murrelets have not been studied specifically. Both global transport of contaminants and former military installations are likely responsible for PCB distributions in the Aleutians (Rocque and Winker 2004, pp. 759,765; Ricca et al. 2008, p. 321). Mercury concentrations in pigeon guillemots (Cepphus columba) were greater in the Aleutians than Prince William Sound and may have been great enough to exceed adverse reproductive effects thresholds for some birds (Burger et al. 2007, pp. 175, 182). The authors noted that seabirds may not be as susceptible to mercury as terrestrial bird species that did not evolve with mercury exposure. Organic contaminant levels in glaucous and glaucous-winged gulls from the Gulf of Alaska may have been high enough to affect chick growth and survival rates (Vander Pol et al. 2009, p. 762).

Sources of contamination have been identified within the range of Kittlitz's murrelet. It is therefore likely that some individuals may be exposed to contaminants concentrations of concern. This may be particularly true for individuals in the far Western Aleutians where long-range contaminants transport may be of particular concern or where birds forage near contaminated sites. Because the number of eggs that have failed to hatch without a known cause is relatively high (15 of 100 monitored), determining whether contaminants concentrations are elevated at these nesting sites is an important line of investigation that should be pursued. We lack sufficient information at this time to conclude that contaminants are a threat to the Kittlitz's murrelet.

Hydrocarbon contamination

Petroleum hydrocarbons in marine waters are considered among the most potentially harmful contaminants to organisms (Martin and Richardson 1991). Petroleum products released into the marine environment can remain for years (Hayes and Michel 1999), with documented adverse effects on marine birds (Custer et al. 2000; Esler et al. 2000; Trust et al. 2000; Yamato et al. 1996) and their prey (Glegg et al. 1999). Chronic exposure to hydrocarbons is associated with risks of cancer, reproductive anomalies, and endocrine dysfunction (Irwin et al. 1997). Petroleum hydrocarbons are frequently introduced into the marine environment within the range of Kittlitz's murrelets and spills are expected to increase in frequency as vessel traffic increases. Therefore, the probability that Kittlitz's murrelets will be exposed to hydrocarbons will increase. The pathway to exposure is either direct through oiling, which can cause death through hypothermia or drowning, or indirect via preening or ingestion of contaminated prey (summarized by Kuletz 1996, p. 770). This increased probability of exposure may result in reduced reproductive success and/or longevity.

Based on the species' marine foraging habits, diving behavior, and high rate of mortality when exposed to oil pollution, among other attributes, the Kittlitz's murrelet is vulnerable to direct mortality from oil pollution, ranking 88 on a scale of 1-100 in an "Oiling Vulnerability Index" (King and Sanger 1979). In 1989, the commercial oil tanker Exxon Valdez spilled nearly 11 million gallons of heavy Alaska crude oil into PWS, contaminating approximately 30,000 km2 of coastal and offshore waters that served as habitat for approximately 1,000,000 marine birds (Piatt et al. 1990). While there were 72 confirmed Kittlitz's murrelet deaths from the spill (van Vleit and McAllister 1994, p. 5) estimates of the number killed ranged from approximately 370 (Kuletz 1996, p. 781) to over 1,000 birds (van Vleit and McAllister 1994, p. 5). In either case, a notable number of individuals were killed. On August 4, 2001 the F/V Windy Bay struck a reef in northern Prince William Sound, sank, and created an oil slick from the hydrocarbons (diesel fuel, lube oil, and hydraulic fuel) on board. An investigation of marine birds affected by the spill indicated that, conservatively, at least 100 murrelets were likely killed, although the number may have been higher. Marbled murrelets were more abundant in the vicinity of wreck and represented all of the documented murrelet mortalities. However, Kittlitz's murrelets also present in the area could have died and not been recovered (Kuletz et al. 2003, pp. 57–61).

In December 2004, the Selandang Ayu spilled approximately 500,000 gallons of heavy bunker C and diesel fuel oils into the nearshore waters off Unalaska, Aleutian Islands, oiling approximately 35 km of shoreline (Alaska Department of Environmental Conservation, Anchorage, Alaska, 2005, unpublished data; Unified Command 2005). Few Brachyramphus murrelet carcasses were recovered after this oil spill (Byrd and Daniel 2007); however, murrelets were observed in oiled waters (Stehn, US Geological Survey, Anchorage, Alaska, 2005, unpublished data). About one-third of all the Kittlitz's murrelet observations made during a survey in 2005 around Unalaska were from Makushin Bay (Romano et al. 2005), an area heavily oiled from this spill. The M/V Selendang Ayu was the third major ship grounding and spill of oil or fuel at Unalaska Island since

1989. All three spills (F/V ChilBo San #6, January 11, 1989, M/V Kuroshima, November 26, 1997, and the M/V Selendang Ayu) occurred near areas that supported high densities of Kittlitz's murrelet (Romano et al. 2005, p. 13). Kittlitz's murrelet mortality from fuel spills and petroleum contamination may go largely unobserved in Alaska's vast and remote waters (Kuletz et al. 2003b, p. 60). Consequently, lack of observed mortality from oil pollution does not confirm its absence. These spills occurred in the winter, a time in which we have little information about the distribution of Kittlitz's murrelet in these areas. Consequently, it is difficult to assess the impact these spills had on the species.

Much of the Aleutian Island's coastal habitat is within the boundaries of the Alaska Maritime National Wildlife Refuge (NWR). Approximately 2,900 ships on US/Asia routes annually traverse a Great Circle Route that takes them in close proximity to these islands. Based on the certainty that oil spills will continue to occur in this region where high volumes of ships traverse dangerous waters, the Alaska Maritime NWR is considered among the most vulnerable refuges in the country (NWRA 2005).

From 1995 through August 2005, at least 1,923 small fuel spills from vessels resulted in the release of more than 271,700 gallons of petroleum hydrocarbons in Alaskan waters (Alaska Department of Environmental Conservation, Anchorage, Alaska, 2005, unpublished data). Ninety percent of those spills occurred within the range of Kittlitz's murrelets. Additionally, cruise ship and recreational boating activity is increasing in glaciated fjords within Glacier Bay, Yakutat Bay and Prince William Sound, in habitats that are important to breeding Kittlitz's murrelets (Day et al. 1999; Murphy et al. 2004; Jansen et al. 2006). Road access has increased recreational boating opportunities in northern Prince William Sound. As vessel traffic increases, so does the threat of petroleum contamination from both accidental spills and routine vessel operation.

In summary, hydrocarbon exposure is a chronic source of mortality of Kittlitz's murrelet juveniles and adults in a relatively large portion of their range. The number of birds that may die or be affected by hydrocarbons annually is undocumented and unknown, but is highly likely to occur. Hydrocarbon contamination is one of several causes of adult mortality, which in sum, based on their K-selected life history, threaten the species.

B. Overutilization for commercial, recreational, scientific, or educational purposes:

The Kittlitz's murrelet was not historically, and is not currently a bird targeted by commercial or recreational interests (Day et al. 1999, p. 17); overutilization from these sources is not a threat. In addition, overutilization for educational purposes has not been documented and is not considered a threat.

Research projects on Kittlitz's murrelet are underway in several locations, some of which involve the capture and handling of birds, collection of biological data or samples from the birds, attaching transmitters, or searching for and monitoring nests. These methods are commonly used to study marbled murrelets in British Columbia (e.g., Lougheed et al. 2002, p. 309), Washington (e.g., Bloxton and Raphael 2005, p. 2), and California (e.g., Peery et al. 2006, p. 78) and in some instances have been shown to affect survival. For example, Peery et al. (2006, p. 85) found that radiomarked marbled murrelets had a lower probability of surviving the year after they were marked than nonmarked murrelets. Initial results of research designed to determine whether nest/chick monitoring has adverse effects on fledgling success of Kittlitz's murrelets indicate that monitoring has not had a negative effect (Lowann et al. 2011, p. 16; Kaler et al. 2011, p. 17). Research conducted to determine the effects of capture and handling on Kittlitz's murrelets showed no relationship between lactate (a metabolite used as an index of muscle fatigue, or stress) and capture attempt, handling, time, sex or season, body condition, age, or reproductive status (Kissling et al. 2010, poster). In 5 years of research from 2005 through 2010 in which 638 birds were captured and handled, 2 capture-related mortalities were recorded (Kissling et al. 2010, poster). In research projects that handle birds, every effort is made to minimize stress and reduce researcher effect on the birds (M. Myers, Service, pers. obs.). Given the relatively small number of birds that are directly affected by research activities and the relatively small portion of their range that is affected by researchers, the Service concludes that overutilization for scientific purposes is not a threat to the population.

C. Disease or predation:

Disease

Except for one record of a tapeworm (Alcataenia) in a Kittlitz's murrelet from Kodiak Island (Hoberg 1984), there is no information available on disease or parasites in this species (Day et al. 1999, p. 16).

Predation

Nelson and Hamer (1995a, p. 66) note that the risk of predation may be the most important factor in the development of alcid behavior. This is particularly true for Kittlitz's murrelets because of their exposed, solitary ground nests, which potentially make them easy targets for both terrestrial and avian predators. Predation by raptors is considered a natural factor that would be a threat only if the rate of predation increased through the introduction of a predator, where habitat was modified to make the birds more vulnerable, where the birds were disturbed by humans, making them more vulnerable (Nelson and Hamer, 1995a, p. 67), or where predator levels were increased artificially through the actions of humans. Juvenile murrelets, especially those on their maiden voyage to the water, and in their first few days, may be particularly vulnerable to predation.

In Icy Bay, peregrine falcons (Falco peregrinus) and bald eagles (Haliaeetus leucocephalus) depredated 4 radio-tagged Kittlitz's murrelets in 2007 (Kissling et al. 2007b, pp. 4). During summer of 2007, approximately 35 Kittlitz's murrelet remains were found in the territories (e.g., eyries and plucking posts) of 3 peregrine falcon pairs in Icy Bay (M. Kissling, Service, 2007, unpublished data). It is unknown what proportion of the prey remains were adult Kittlitz's murrelets versus young of the year. Nesting peregrine falcons were not observed during a bird survey in Icy Bay in 1993 (Kozie 1993). The current number of nesting peregrine falcons in Icy Bay may represent a recent increase in the peregrine falcon population as a consequence of the overall recovery of the species and expansion of range (S. Lewis, Service, pers. comm.). Because the peregrine eyries are located on the cliff walls overlooking the bay, Kittlitz's murrelets are an easy target. Peregrine falcons have also been observed perching on vessel flagpoles and taking murrelets on the water (K. Kuletz, Service, pers. comm.).

Twenty-seven percent of nests (18 of 66 nests) were depredated at Agattu Island from 2005-2010. Arctic foxes (Vulpes lagopus) were eradicated from the island in the late 1970s and are therefore not a potential predator (Kaler and Kenny 2008, p. 5). Predators of ground-nesting birds at the island include glaucous-winged gulls (Larus glaucescens), common ravens (Corvus corax), and peregrine falcons (Kaler and Kenny 2008, p. 5). It is unknown which of these predators are responsible for the depredation of chicks and eggs at Agattu. At Kodiak Island, several potential predators have been identified (Lawonn et al. 2011, Appendix A). In addition to the species mentioned above, merlin (Falco colombarius), golden eagles (Aquila chrysaetos), parasitic jaeger (Stercorarius parasiticus), black-billed magpie (Pica hudsonia), northern shrike (Lanius excubitor), and brown bear (Ursus arctos) were all observed within 1 km of the nest study area. Red foxes, which are native on this island, were the only documented predators (Lawonn et al. 2011, p. 15).

Increases in the number of predators may have occurred in three locations as the result of human actions. Glaucous-winged gull abundance may be artificially inflated in the Aleutian Islands due to refuse from seafood processing (Gibson and Byrd 2007). These gulls are potential predators of eggs and chicks (Kaler et al. 2009, p. 365). In the Kachemack Bay area, intentional feeding of bald eagles led to a population size that was much greater than could have been supported without the supplemental food. This practice was ended in 2009; however, the supplemental feeding had occurred for over 20 years (http://www.adn.com/2009/01/15/654023/homers-eagle-lady-dead-at-85.html, viewed April 19, 2011). It is unknown if this artificial increase in bald eagles increased predation on Kittlitz's murrelets. Lastly, although red foxes are native to Kodiak Island, several species upon which they can prey upon or scavenge have been introduced including Sitka black-tailed deer (Odocoileus hemionus sitkensis), red squirrel (Tamiasciurus hudsonicus), snowshoe hare (Lepus americanus), pine marten (Martes americana), mountain goats (Oreamnos americanus), Roosevelt elk (Cervus canadensis roosevelti), reindeer (Rangifer tarandus), beaver (Castor canadensis) (http://kodiak.fws.gov/wildlife.htm). Although historical and current fox populations are unknown, it seems likely that a higher population could be supported with the additional sources of food. Consequently, the chances of a fox encountering a Kittlitz's murrelet nest by chance may be increased over the historical condition.

In summary, predation is a source of mortality of eggs, chicks, and adults. Although strategies against predation have been identified for all life history stages, it is clear that predation is a regular occurrence. It appears that predation levels may be enhanced in certain locations as a result of the actions of humans. Predation in and of itself is not considered a threat to the species. However, we do find that predation in combination with other factors is an ongoing source of mortality of eggs, chicks, and adults, which collectively may be affecting reproductive success.

D. The inadequacy of existing regulatory mechanisms:

Several Acts have been passed to help maintain the quality of habitat that Kittlitz's murrelets occupy and reduce threats to them. These are discussed briefly below.

Oil Pollution Act (OPA) of 1990

Oil spill response in Alaska is regulated by the 1990 OPA, which requires the U.S. Coast Guard (USCG) and the Environmental Protection Agency (EPA) to develop a statewide oil spill response plan, and by Alaska Statute 46.04, which requires the Alaska Department of Environmental Conservation (ADEC) to develop a statewide response plan and individual response plans for ten geographic subareas spanning the State of Alaska (Oil Pollution Act of 1990 (33 U.S.C. 2701-2761; http://www.uscg.mil/NPFC/About_NPFC/opa.asp; Alaska Statute Title 46, Water, Air, Energy and Environmental Conservation, http://www.dec.state.ak.us/SPAR/statutes_regs.htm). Finally, Alaska Statute 46.04 requires that the oil industry develop oil discharge prevention and contingency plans. Despite planning efforts, the Coast Guard has no offshore response capability in Northern or Western Alaska and we only dimly understand the science of recovering oil in broken ice. (O'Rourke 2010, p. 23). Hydrocarbon contamination within the range of Kittlitz's murrelets is typically caused by accidents. Although plans for spill response can be made which may help limit losses, it is not possible to regulate against accidents.

Coastal Zone Management Act (CZMA)
The CZMA (16 U.S.C. 1451 et seq.) was enacted to "preserve, protect, develop, and where possible, to restore or enhance the resources of the Nation's coastal zone." The CZMA is a state program subject to Federal approval. The CZMA requires that Federal actions be conducted in a manner consistent with a state's coastal zone management plan to the maximum extent practicable. Federal agencies planning or authorizing an activity that affects any land or water use or natural resource of the coastal zone must provide a consistency determination to the appropriate state agency. The CZMA is applied in Alaska through the Alaska Coastal Management Program (ACMP). The primary tool used to implement the ACMP is the consistency review process at 11 AAC 110. Through this process, proposed resource development activities are reviewed for consistency and compliance with the State's coastal management program which includes State laws, State standards, and district enforceable policies. Protections to Kittlitz's murrelets and their habitat are considered through incorporation of local district input and application of State ACMP enforceable policies to Federal agency activities.
Marine Protection, Research and Sanctuaries Act (MPRSA)

The Marine Protection, Research and Sanctuaries Act (MPRSA, 33 U.S.C. 1401 et seq.) was enacted in part to "prevent or strictly limit the dumping into ocean waters of any material that would adversely affect human health, welfare, or amenities, or the marine environment, ecological systems, or economic potentialities." The MPRSA was designed to protect the quality of marine habitats that Kittlitz's murrelets rely upon.

Migratory Bird Treaty Act (MBTA)

Although the MBTA has no provision to allow for incidental take of any migratory bird, including Kittlitz's murrelets, such take does occur in commercial fisheries in Alaska (Stehn et al. 2001). Murrelets do not appear to be taken by longliners, trawlers, or within pot fisheries (Stehn et al. 2001). However, where studies have examined seabird bycatch in nearshore gillnet fisheries in the range of Kittlitz's murrelets, murrelets (marbled and Kittlitz's) comprise between 11 percent and 70 percent of seabird mortality from gillnets (Wynne et al. 1992; Carter et al. 1995; Manly et al. 2003, 2007). As noted below (see Factor E), gillnet bycatch is an ongoing source of mortality to Kittlitz's murrelets. Gillnet fisheries in Alaska generally occur within State territorial waters, within the undisputed regulatory jurisdiction of the MBTA and fisheries managed by the State. Melvin et al. (1999) report on gear types and fishing methods that reduce such bycatch, but regulations requiring the use of bycatch reduction techniques are not in place.

The Kittlitz's murrelet receives no special protection by the State of Alaska. On March 5, 2009, The Center for Biological Diversity (CBD), an environmental organization, petitioned the State of Alaska to list the Kittlitz's murrelet as endangered under the Alaska Endangered Species Act (AS §§ 16.20.180 – 210). The petition specified that because of their small population size, precipitous population declines, and multiple, ongoing threats to its continued existence, the Kittlitz's murrelet should receive State-level regulatory protection. On April 9, 2009, the state rejected CBD's petition to list the Kittlitz's murrelet as endangered under the Alaska Endangered Species Act, claiming insufficient evidence indicating that their numbers have decreased to the extent to cause endangerment.

E. Other natural or manmade factors affecting its continued existence:

Recreational Effects

This small, cryptic-colored seabird is rarely sought out by tour boat operators; however, the scenic tidewater glacier habitat with which it is associated is the ultimate destination for many recreational and commercial tour boats throughout southeast and south central Alaska (Murphy et al. 2004). Recreational and commercial tourism has increased substantially in many of its breeding areas, especially Glacier Bay, Yakutat Bay, Prince William Sound, Kenai Fjords, and lower Cook Inlet/Kachemak Bay (Glacier Bay National Park, Alaska, unpublished data; Murphy et al. 2004; Hoover-Miller et al. 2006; Jansen et al. 2006). The number of cruise ships allowed into Glacier Bay has increased 30 percent since 1985, while smaller charter boats and private boats have increased 8 percent and 15 percent, respectively. Mid-sized tour boat traffic has remained stable (Glacier Bay National Park, Alaska, unpublished data). Up to 30 percent of the Kittlitz's murrelets observed took flight as a result of boating disturbance in Glacier Bay (Agness et al. 2008, p. 352). Agness et al. (2008, p. 352) found that Kittlitz's murrelets were temporarily disturbed by vessel activity near-shore, but returned to the same habitat within a day. Vessels that were large or vessels traveling at faster speeds caused the greatest disturbance to Kittlitz's murrelets (Agness et al. 2008, pp. 351–352). Stephensen (2009, pp. 22–23) also found temporary disturbance to Kittlitz's murrelets by boats conducting surveys and Kuletz (1996, pp. 777–778) found that there was a negative relationship between the number of murrelets seen and the number of boats observed near survey transects in Kachemak Bay and Naked Island (Prince William Sound) in 1989.

Most human use in Prince William Sound is concentrated in the northwestern section, and in central mainland fjords with tidewater glaciers, the same areas favored by Kittlitz's murrelets (Murphy et al. 2004; Kuletz et al. in press, Figs. 2 and 3). In Prince William Sound and Kenai Fjords, peak vessel activity occurs in June and July (B. Conner, National Park Service, Seward, Alaska, pers. comm.; Murphy et al. 2004), a time when Kittlitz's murrelets face intense energetic requirements to complete chick-rearing, and when new fledglings first enter marine waters and must quickly learn to forage on their own. It is unclear to what degree murrelets may habituate to boat traffic (Speckman et al. 2004, pp. 32–33), and to what degree it may disrupt normal feeding patterns (Speckman et al. 2004, p. 33), or prevent murrelets from using high quality foraging areas (Day et al. 2003, p. 697). Disturbance causing reduced access to high energy food and increased energetic demands could negatively affect longevity and reproduction in Kittlitz's murrelets; however, we lack data to confirm that this is occurring.

Among all Kittlitz's murrelet population strongholds, Southeast Alaska's Icy Bay is the only fjord that remains relatively free of tourist traffic and commercial fishing (although the first cruise ship was observed in Icy Bay in July 2009). This is the only location where Kittlitz's murrelets still outnumber all other alcids (Kissling et al., in press). Whether this correlation is related to the absence of anthropogenic effects or other environmental factors is unknown.

In summary, Kittlitz's murrelets can be disrupted from their normal activities by boats. Their reaction appears to depend on boat speed, size, and distance from the birds. Although one study noted that birds became habituated to boat traffic (Speckman et al. 2004, pp. 32–33) another found a negative relationship between number of boats and number of murrelets (Kuletz 1996, pp. 777–778). This source of disturbance is limited to one part of their range; however, it is an important part because of the number of breeding birds that have been documented using this area. Because this stressor is relatively limited in scope geographically and we do not have information that this stressor is affecting adult survival or nesting success, we conclude that it is not a threat to the species.

Commercial Fisheries

Commercial gillnet fisheries take an unknown number of Kittlitz's murrelets and our information on this source of mortality is still rudimentary. In Prince William Sound, salmon gillnet fisheries occur each summer in or near Kittlitz's murrelets' habitat. In 1990, in Prince William Sound and South Unimak, marine birds encountered fewer than 5 percent of the observed sets and got entangled in less than 2 percent of the driftnets (Wynne et al. 1991, p. 59). However, murrelets were caught in much higher numbers than any other bird (54 marbled, 6 unidentified, and 3 Kittlitz's murrelets) (Wynne et al. 1991, p. 32). In 1991, observers of 5,875 net sets in Prince William Sound recorded 7 entangled (dead) Kittlitz's murrelets and estimated from the sets observed that approximately 133 were killed that year (Wynne et al. 1992, Table 13). Murres and murrelets were the species most commonly caught in the nets (Wynne et al. 1992, pp. 18-19). Impact from gillnet fisheries may be localized, possibly as a result of the patchy distribution of this species. In 1999 and 2000, a similar study by the National Marine Fisheries Service in lower Cook Inlet recorded no take of Kittlitz's murrelets, although an estimated 37 marbled murrelets were taken (Manley et al. 2003, pp. 5, 75). In July 2005, a juvenile Kittlitz's murrelet was killed in a gillnet fishery off Kodiak Island, resulting in an estimated take in that area of 18 birds (Manly et al. 2007, pp. 6, 36) and in July 2008, an adult Kittlitz's murrelet was killed in a gillnet in Yakutat Bay (Manly et al. 2009). There are also anecdotal reports and opportunistic observations of both Brachyramphus species being taken in gillnet fisheries in other areas of south central and southeast Alaska (Manly et al. 2007, Manly 2009). Studies on the effects of gillnet fisheries on murrelet species (Carter et al. 1995, p. 271) strongly suggest that gillnet fishery bycatch is a conservation concern for Kittlitz's murrelets. However, we have insufficient data to determine whether bycatch contributes substantially to the observed decline in Kittlitz's murrelets in recent years.

As we acquire new information about diurnal and seasonal migration patterns of Kittlitz's murrelets, we may discover overlap between their distribution and commercial fisheries. But until more is known about the night-time and winter distribution of Kittlitz's murrelets, significant mortality from commercial fisheries such as near-shore gillnetting and high-seas fisheries cannot be discounted. Such mortality events of alcids have been documented; a significant proportion of the population of Japanese murrelets (Synthliboramphus wumizusume) was reportedly killed in high-seas drift net fisheries in the North Pacific (Piatt and Gould 1994, p. 953).

Because Kittlitz’s murrelets dive and swim underwater to catch their prey, gillnets are a recognized source of mortality. More marbled murrelets have been caught in gillnets but this is most likely a reflection of their greater abundance compared to Kittlitz’s murrelets and demonstrates how vulnerable these birds are when their foraging areas overlap with gillnet operations. Although we have information on by-catch during their summer breeding season, we do not know if any commercial gillnet operations overlap with winter distribution. Stable populations of K-selected species, such as the Kittlitz’s murrelet, are characterized by low annual productivity rates balanced with high annual survival rates, meaning that individuals must live many years to replace themselves with offspring that survive to recruit into the breeding population. Loss of adults has greater population-level effect than loss of eggs and chicks. Mortality from gillnets, does not rise to the level of a threat on its own; however, we do find that mortality from gillnets, in combination with other factors that increase adult mortality, is a threat to the species.

Population ecology

Nest monitoring indicates that reproductive success at Agattu and Kodiak Islands is currently very low (Kaler et al. 2009, p. 9; Kaler et al. 2011, pp. 17–18; Lawonn et al. 2011). The Mayfield estimates of nest survival on Agattu were 0.06 $\pm$ 0.030 (N=11) in 2006, 0.06 $\pm$ 0.060 (N =16) in 2008, 0.085 $\pm$ 0.077 (N =13) in 2009, and 0.059 $\pm$ 0.079 (N =18) in 2010 (Kaler et al. 2011, p. 18). For comparison, nest survival for marbled murrelets has been measured at 0.28 (N=32) (Nelson and Hamer 1995b, p. 91) and 0.48 (N=116) (Bradley et al. 2004, p. 324). Success rate appears to be higher in the mainland area around Icy Bay, where 5 chicks likely fledged (3 of the 5 were presumed fledged, based on the behavior of the adults, 2 were observed to fledge); however, the total number of nests monitored is low (10 nests, found over 4 years) (Kissling, in litt. 2011). Day and Nigro (2004, p. 93) calculated that based on a demographic model constructed by Beissinger (1995) for marbled murrelets, that annual fecundity to fledgling would need to be 0.39/pair for the population to remain stable, assuming annual survivorship of adults was 85 percent. If annual survivorship of adults was 90 percent, annual fecundity to fledgling would drop to 0.23. We note that adult survivorship is unknown for Kittlitz’s murrelets, but that based on the results from Agattu, fecundity over the years observed is too low to maintain a stable population.

A variety of sources of mortality have been documented. A large number of eggs have not been viable (6 of 34 at Kodiak, 9 of 66 at Agattu, 1 of 10 at Icy Bay). In only one instance do we know the reason; the death of one parent, which prevented completion of the incubation period (Kissling, unpublished data). Predation caused the failures of 56 percent of nests (19 of 34) at Kodiak, 27 percent (18 of 66) of nest failures at Agattu, and 10 percent (1 of 10) nest failures near Icy Bay. “Accidents,” where the chicks fell out of the nest caused 3 deaths (one each at Agattu, Kodiak, and Icy Bay), and exposure or starvation were implicated in 29 of 66 nests, all at Agattu. There is the possibility that oceanic conditions are such that provisioning the chicks with sufficient forage is problematic. Further research may indicate that prey is either more abundant or of higher quality in the glacially influenced waters of southeast and south central Alaska, leading to better nest success rates. It is also possible that contaminants may be affecting nest success on these island locations.

Juvenile recruitment of Kittlitz’s murrelets remains largely unobserved, despite survey effort (Day and Nigro 1999, p. 32; Day and Nigro 2004, pp. 89-90; Kuletz et al. 2008; M. Kissling, Service, 2010, pers. comm.). As described above, this may be a consequence of the difficulty in identifying juveniles or it may be because the juveniles do not stay within the enclosed bays near their nest, but instead head out to coastal waters. However, juvenile marbled murrelets are regularly seen, even where the adults are relatively uncommon (e.g., Icy Bay), so either juveniles of the two species have different life history characteristics, juvenile recruitment in Kittlitz’s murrelet truly is very low as suggested by Day and Nigro (2004, pp. 92-94), or years of good recruitment are infrequent and difficult to document.

Another area of concern is the apparently low number of birds that appear to be nesting. As discussed above, in 2007-2008 triglyceride and/or vitellogenin levels were measured in female Kittlitz’s murrelets captured in Icy Bay as a means to measure fecundity. About 90 percent of female Kittlitz’s murrelets captured had elevated triglyceride and/or vitellogenin levels (M. Kissling, Service, 2010, unpublished data); however, only about 10 percent of the adult birds that were captured nested (Kissling et al. 2010a, p. 16). It would be difficult for the population to maintain itself with so few of the females attempting to nest, especially if this is a range-wide phenomenon and not restricted to Icy Bay. The birds are arriving in Icy Bay in good condition so it is difficult to understand this result. Continued research in this area is needed to help clarify what is happening.

Currently our greatest concern for the Kittlitz's murrelet centers on a rate of reproductive success that appears to be too low to maintain a stable population. We recognize that the results from the islands do not represent the full breeding range of the species and that perhaps the island habitats do not accurately represent all breeding habitat. In addition, for a long-lived species reproductive success could be poor for several years without having a population-level effect and we have been able to monitor nesting success for relatively few years. However, there is evidence from enough lines of reasoning to suggest that this is the primary threat to the species at this time. Nearly half the chicks at Agattu died because of exposure or starvation. Although this population has not been monitored long enough to indicate whether the years from 2006 to 2010 were an anomaly in terms of weather patterns or forage availability/quality, it does indicate how difficult it is for this species to fledge a chick. The changes in oceanographic conditions, whether brought about by climate change directly or through regional climatic shifts appear to have had an impact on the species composition and abundance of forage fish. Because of Kittlitz's murrelet dependence on high-energy fish as food for their chick, changes in the availability or quality of the prey could impact fledgling success and may, in part, explain the loss of chicks at Agattu. The observation that although 90 percent of the females appear to be fecund, only 10 percent attempt to nest at Icy Bay is another indicator that environmental or physiological conditions are not suitable for breeding. However, we cannot rule out other possible causes for this observation. As discussed above, elevated contaminant levels through ice melting or atmospheric transport could be entering the food chain and affecting reproductive success. More research is needed before we can determine if this is happening. Because multiple lines of evidence indicate that reproductive success may be at levels too low to sustain the population over time, we conclude that low reproductive success is a threat to the species.

Conservation Measures Planned or Implemented :

No conservation agreements are known to exist. Because of previously limited knowledge of this species, no conservation measures have been implemented to date. However, research studies are ongoing or planned in several areas (including Prince William Sound, Icy Bay, Kodiak Island, and Agattu), and results may assist the development of future conservation measures. In 2010, the Service completed the Spotlight Species Action Plan for this species, which identified the actions we will pursue in cooperation with our partners over the next 5 years, to further its conservation (described below). In addition, a Symposium on the status and trends of Kittlitz's murrelet was held at the Pacific Seabird Conference in 2010 and we anticipate that the symposium proceedings will greatly aid our ability to assess the status of this species. Kittlitz's murrelet is a Focal Species for the Migratory Bird Management branch of the Service.

Summary of Threats :

The present or threatened destruction, modification, or curtailment of its habitat or range:
In our analysis of Factor A, we determined that climate change is modifying Kittlitz's murrelet habitat, particularly through the loss of glaciers in southeast and south central Alaska. How this modification of habitat may affect their population is not clear. A warming climate is increasing glacial melt and the release of contaminants from glaciers has been noted elsewhere; however, we have no information on the release of contaminants from glaciers in Alaska. Changes in the marine environment have caused changes to the prey base of Kittlitz's murrelets. There is evidence that these changes led to a population decline in Kittlitz's murrelets as well as many other sea birds in the range of Kittlitz's murrelets. The magnitude of decline for

Kittlitz's murrelets is unknown. There are known sources of contaminants within the range of Kittlitz's murrelets and levels of contaminants have been measured in other species of sea birds. Although an area of concern, we have insufficient information to conclude that contaminants are a threat. Hydrocarbon spills occur on a regular basis and Kittlitz's murrelets are very susceptible to the effects of oiling. We find that the chronic loss of adults and juveniles from this stressor, in combination with other sources of adult and juvenile mortality is a threat to the species.

Overutilization for commercial, recreational, scientific, or educational purposes:
We determined that overutilization commercial, recreational, scientific, or educational purposes is not a threat.

Disease or predation:
No large disease-related mortality events have been documented for Kittlitz's murrelets. Predation is a natural event that and this species has evolved several strategies to minimize predation. We did identify certain areas in which predators have been increased through the activities of humans; however, we do not know if this has translated into increased predation on
Kittlitz's murrelets. We determined predation is not a threat in of itself unless artificially increased, but it is an important and ongoing source of mortality that limits reproductive success.

The inadequacy of existing regulatory mechanisms:
Regulatory mechanisms are viewed in light of how they may remove or alleviate identified threats. In the case of Kittlitz's murrelets we find that low reproductive success is the primary threat facing the species. Our understanding of the reasons for the poor reproductive success is still rudimentary. Hydrocarbon contamination, which has been identified as a source of mortality to chicks and adults, is primarily the result of accidents. Although regulations are in place to plan for the response to spills, there is not a way to regulate accidents. At this time no regulatory mechanism has been identified that would alleviate this threat. Regulatory mechanisms for gillnet bycatch do not exist.

Other natural or manmade factors affecting its continued existence:
In our analysis of Factor E, we identified and evaluated the effects of recreational activities, commercial fisheries, and reproductive success. Recreational activities overlap with the Kittlitz's murrelets, especially near tide-water glaciers and harbors in southeast and south central Alaska where tourism and fishing activities are high compared to other part of their range. Boats can cause the birds to flush or dive depending on boat speed, size, and distance to the birds. Flying or diving is an increase in energy expenditure over floating on the water; however, we do not have information at this time indicating that this change in behavior is leading to reduced survivorship in adults or their chicks. Kittlitz's murrelets are susceptible to entanglement in gillnets and there has been documented loss of birds in nets. Mortality from gillnets does not rise to the level of a threat on its own; however, we do find that mortality from gillnets, in combination with other factors that increase adult mortality, is a threat to the species. Currently our greatest concern for the Kittlitz's murrelet centers on a rate of reproductive success that appears to be too low to maintain a stable population. Our concern is based on three lines of reasoning: the low level of nest success documented on Agattu and Kodiak Islands (less than 10 percent); the low reported incidence of juvenile birds; and indications that few females are breeding. We recognize that there are limitations to the scope of inference we have from these three lines of evidence, primarily that the results of the research are geographically limited and the length of time that the nesting surveys have been done is limited to 5 years. However, we also cannot ignore the implications of these results and their potential outcome on population viability.

For species that are being removed from candidate status:

_____ Is the removal based in whole or in part on one or more individual conservation efforts that you determined met the standards in the Policy for Evaluation of Conservation Efforts When Making Listing Decisions(PECE)?

Recommended Conservation Measures :

1. Collaborate with Alaska Department of Fish and Game and fishermen to determine the magnitude of gillnet fishery bycatch. If deemed necessary, test gillnet fishing gear or methods to reduce bycatch mortality. The Kittlitz's murrelet could benefit from cooperation between government agencies and fishermen, such as has occurred in the Alaska longline fishery. Seabird bycatch in the Alaska longline fishery has been drastically reduced due to: 1) the development and distribution of seabird deterrent devices; 2) outreach and education efforts explaining to fishermen how to catch fewer seabirds and why catching fewer seabirds is desirable; and 3) promulgation and enforcement of regulations requiring the use of seabird avoidance techniques and deterrent devices.

2. Work with/educate the tourist industry and recreational boaters on the need to minimize speed and reduce disturbance to Kittlitz's murrelets in upper fjords with tidewater glaciers.

3. Work with Alaska Department of Environmental Conservation and their project partners to initiate consideration of oil spill risk to Kittlitz's murrelets when developing new, and reviewing old Geographic Response Strategies.

4. Collaborate with universities, and State and Federal agencies to fill needed data gaps in Kittlitz's murrelet biology that include: demographics, diet, fledging dispersal, diurnal and seasonal migration, and distribution/abundance in areas not well surveyed.

5. Prepare and distribute Kittlitz's murrelet adult/juvenile identification training materials to at-sea observers so that more may be learned about juvenile dispersal. Prepare and distribute information about nest, egg, chick, and adult identification to researchers who may opportunistically encounter nests while doing field work.

6. Work with the International community (e.g., Russia and Japan) to assess the potential risk to Kittlitz's murrelets from at-sea drift net fisheries.

7. Work with Russian partners to collect genetic material from Russian-breeding and wintering Kittlitz's murrelets for analyses and comparison with North American specimens. Continue studies to further clarify the population genetics throughout the range by increasing sample size and including samples from populations in intermediate areas.

8. Use important nest site parameters to delineate existing potential nesting habitat and how that will change over time with plant succession and glacial recession.

9. Determine the reasons for egg inviability.

10. Investigate levels of contaminants in adults, chicks, inviable eggs, and prey.

11. Investigate potential molting/staging areas (e.g., Port Heiden).

12. Investigate nesting success rates at mainland sites. A simple model using known nest site characteristics could be developed and used to target areas with a high probability of occupancy. Once nests are located use techniques that have already been developed to monitor nest outcome.

13. Compare chick provisioning at Agattu and Kodiak vs. mainland sites in southeast or south central Alaska to determine if there is a difference in food quality or quantity being delivered to chicks.

14. Continue long-term monitoring of nest success on Agattu and Kodiak. Without a long-term time frame we will be unable to have context for the short-term data that has already been collected. The value of the information collected to date will be of limited use compared to what could be gained through long-term monitoring at these sites.

15. Develop a demographic model for Kittlitz’s murrelet.

Priority Table

Magnitude	Immediacy	Taxonmomy	Priority
High	Imminent	Monotypic genus	1
		Species	2
		Subspecies/Population	3
	Non-imminent	Monotypic genus	4
		Species	5
		Subspecies/Population	6
Moderate to Low	**Imminent**	Monotypic genus	7
		Species	**8**
		Subspecies/Population	9
	Non-Imminent	Monotype genus	10
		Species	11
		Subspecies/Population	12

Rationale for Change in Listing Priority Number:

We concluded in the past that the loss of tidewater glaciers was a threat to the species and the magnitude of that threat was high because of the rate of change in the glaciers. There is no doubt that tidewater glaciers are receding and that climate change is the cause. It is also clear that in one part of their range, Kittlitz’s murrelets are associated with glacially influenced waters during the summer breeding period. What is unclear is the nature of the association and if these areas are more important to the Kittlitz’s murrelet population viability than other areas. Nests have been documented throughout their range; what is unknown is if nest survival is better near glaciers. Although we know that Kittlitz’s murrelet habitat will continue to be modified as glaciers continue to recede, we currently do not have evidence that this modification will lead to conditions that will lead to a population level decline. Continued monitoring will be important to track population trend in these areas.

In the past we had a high level of concern over the population decline and its magnitude. Although we still conclude that the population has declined, the magnitude of the decline is much less certain. Work is currently underway to evaluate past surveys and the status and trend of Kittlitz’s murrelet across its range. We anticipate that our ability to evaluate trends and population size will be greatly improved when these projects are completed and published.

For these reasons, this year our focus shifted from the loss of glaciers to poor reproductive success. Poor nest success (as opposed to adult mortality) could be the underlying reason for the population decline, and if it is occurring range-wide, the population would be expected to continue to decline. Currently, our most detailed nest information comes from Agattu and Kodiak Islands. Whether these locations and the time-frame observed are representative of the range-wide situation, is unknown; therefore, we have determined that threat magnitude is moderate, not high. Determining the reasons for the poor reproductive success, and determining if it is a range-wide phenomenon should be research priorities.

Magnitude:

Magnitude— We conclude that the magnitude of threat to Kittlitz’s murrelet is moderate. Of greatest concern is the low reproductive success. Our concern is based on three lines of reasoning: at the locations where we have the most complete information, Agattu and Kodiak Islands, nest success is very low (less than 10 percent); the incidence of juvenile birds appears to be very low, with few documented; and indications that few females (approximately 10 percent) are breeding in spite of the fact (based on blood chemistry) that they appear to be physiologically prepared to breed. Although the implications of these results are serious, we must temper our concern with the knowledge that the results are limited to small parts of their range and for a long-lived bird, we have data for relatively few years.

For a K-selected species such as Kittlitz’s murrelet, loss of the adults is particularly important and we have identified several sources of adult mortality such as hydrocarbon contamination, entanglement in gillnets, and predation. Although none of these sources of mortality alone rises to the level of a threat, in total, the chronic, low-level loss of adults in combination with evidence that a small proportion of the population is breeding, and the low reproductive success leads us to conclude that it will be difficult for this species to maintain a stable population level or rebound from a stochastic event that causes population loss. We consider the magnitude of threat from these sources to be low to moderate, depending on events that occur in a given year (number and location of oil spills/ship wrecks, number and location of gillnets).

Although documenting the magnitude of population decline that has occurred in Kittlitz’s murrelet is difficult for the reasons described above, the Service concludes that a decline has occurred. If reproductive success is low range-wide, we would anticipate that the population will not be able to stabilize and will continue to decline. Continued monitoring throughout the range will be essential to track the population in the future.

Imminence :

Imminence--Threats to Kittlitz’s murrelet adults are ongoing and include hydrocarbon contamination and bycatch in commercial fisheries. In addition, several lines of evidence point to poor reproductive effort and success with no lines of evidence to the contrary. Consequently, we conclude that the combined threats to the species are imminent.

__Yes__ Have you promptly reviewed all of the information received regarding the species for the purpose of determination whether emergency listing is needed?

Emergency Listing Review

__No__ Is Emergency Listing Warranted?

Emergency listing of Kittlitz’s murrelet is not warranted at this time. Although reproductive success appears poor, the population decline appears to not be as precipitous as we thought, and no threats are so grave as to immediately threaten the existence of the population.

Description of Monitoring:

The Service, U.S. Geological Survey, U.S. Forest Service, and National Park Service have conducted population surveys in areas used by Kittlitz's murrelets including: 1) Prince William Sound in 1972, 1989, 1990, 1991, 1993, 1996, 1998, 2000, 2001, 2003, 2004, 2005, 2007, 2009, 2010 (Kuletz et al. 2003a,b; McKnight et al. 2003; McKnight et al. 2008; Stephensen 2009); 2) Southeast Alaska in 2002, 2003, 2004, 2005, 2007, 2008 and 2009 (Kissling et al. 2007; Kirchhoff 2008; Kirchhoff et al. 2010; Kirchhoff et al. in press; Kuletz et al. a, in press; Kissling et al. in press); 3) Aleutian Islands in 2003, 2004, and 2005, 2006 (Romano and Piatt 2005; Piatt et al. 2005; Romano et al. 2005; Piatt et al. 2007); 4) Alaska Peninsula in 2003 (van Pelt and Piatt 2005); Kenai Fjords in 2002 and 2006 (Romano et al. 2006; van Pelt and Piatt 2003, Arimitsu et al. in press); 5) Lower Cook Inlet in 1993, 1996, 1997, 1998, 1999, 2004, 2005, 2006, and 2007 (Piatt et al. 2002, Kuletz et al. b, in press); and 6) Yakutat Bay in 2009 Stephensen and Andres 2001, Kissling et al. in press).

In 2002 and 2005 the Service collaborated with NOAA gillnet bycatch studies on Kodiak Island to assist in species identification and processing of bird carcasses in conjunction with NOAA studies of marine mammal and other fish bycatch. This collaboration continued during NOAA's 2007 and 2008 study of gillnet bycatch in the Yakutat salmon fishery.

A collaborative study with the University of Washington, US Geological Survey, and Alaska Department of Fish and Game was conducted to assess the effects of human disturbance on Kittlitz's murrelets in Glacier Bay (Agness 2006).

In 2006, the Service with support from the North Pacific Research Board (NPRB) and in collaboration with the National Oceanic and Atmospheric Administration (NOAA) commenced a multi-year study to conduct at-sea pelagic bird surveys aboard a NOAA and other research vessels. Similar pelagic surveys were conducted as part of the Bering Sea Integrated Ecosystem Research Program (BSIERP Project B64; www.nprb.org?)

Beginning in 2006, the Service and a graduate student from the University of Massachusetts, with support from the National Fish and Wildlife Foundation, embarked on a 4-year study of marine habitat use and foraging of seabirds, including Kittlitz's murrelets in five fjords within Prince William Sound.

In 2006, the Service and ABR, Inc. began a comparative study of plumage variations among museum specimens and live captured Kittlitz's murrelets.

In 2007, the Service and the National Park Service commenced a 5-year study to investigate population declines of Kittlitz's murrelets in Icy Bay, Wrangell-St. Elias National Park and Preserve. The ultimate goal of this work is to estimate population parameters necessary for demographic modeling. VHF radio-transmitters will be applied to up to 75 Kittlitz's murrelets and solar-powered satellite transmitters to up to 10 Kittlitz's murrelets for the purposes of estimating population growth rate by generating empirical estimates of adult survival, reproductive measures, and population abundance. This study received continued funding through 2011; final reports and publications are expected in 2012.

In 2007, the Service, National Park Service and others began evaluating Kittlitz's murrelets for mercury and other contaminants. Samples have been collected and submitted to the laboratory; results are pending.

In 2008, the Service, National Park Service, Dancing Star Foundation, and Wildlife Conservation Society collaborated with Oregon State University to support a graduate student to study trophic foraging ecology and reproductive energetics of Kittlitz's murrelets in Icy Bay, Alaska. This study is expected to be completed in 2011.

In 2008, the US Geological Survey in partnership with the Service initiated a pilot study on nesting Kittlitz's murrelets at Kodiak Island. This survey followed a brief radar study that identified potential nesting habitat on the Island (Day and Barna 2007). The main goals of the study were to: 1) study the behavior of Kittlitz's murrelets during their early morning and late evening hour visits to the site (and quantify arrival-departure patterns, visual sightings, vocalizations, courtship displays, etc.); 2) search for and locate nest sites on the ground; and, 3) if successful in locating nests, characterize the nest site habitat, and monitor the development of eggs and chicks at the site (Burkett and Piatt 2008; Lowann 2009). This study has continued, and in 2011 research will be conducted by a graduate student from Oregon State University who received a support grant from NPRB in 2011 (WWW.nprb.org/).

After finding nests in 2006, the Alaska Maritime National Wildlife Refuge and US Geological Survey initiated a study in 2008 to monitor Kittlitz's murrelet nests on Agattu Island in the Aleutian Islands (Kaler and Kenney 2008; Kaler et al. 2009; Kaler et al. 2010, Kaler et al. 2011). This study will continue with the following long-term objectives: 1) describe habitat characteristics of nest sites; 2) quantify breeding chronology; 3) determine chick growth rates, nestling diet and adult nest attendance patterns; 4) measure nest survival rates and overall reproductive success; 5) collect genetic samples for comparative study of murrelet populations; and 6) measure research-influenced nest success.

In 2010, the Service and ABR, Inc. began an effort to summarize available information on the distribution and at-sea abundance of Kittlitz's murrelets in northern Alaska, resulting in a report that will be published in the Pacific Seabird Symposium Proceedings (Day et al. in press).

In 2008, the US Geological Survey in partnership with the Service began a 5-year, comprehensive study to fill data gaps regarding phylogenetics, demography, nesting biology, distribution, status and trends of Kittlitz's murrelets in Alaska. The objectives of the study are to: 1) clarify the phylogeographic variation among Kittlitz's murrelet populations and sub-populations; 2) measure components of demography such as reproductive success and study nesting biology (e.g., meal deliveries, diet composition, chick growth and survival); 3) determine seasonal patterns of Kittlitz's murrelet distribution and migratory movements; and 4) compile available information and fill gaps in our knowledge of population status and trends throughout the range of Kittlitz's murrelets.

In 2010, the Service, with financial support from the NPRB and in collaboration with NOAA commenced a 2-year at-sea pelagic survey to assess abundance and distribution of seabirds, including Kittlitz's murrelets in the Gulf of Alaska (GOA-Integrated Ecosystem Research Program; http://gulfofalaska.nprb.org/index.html).

The Service will continue to monitor Kittlitz's murrelet populations in Prince William Sound for the purposes of estimating abundance and comparing with previous estimates for a trend analysis.

In 2011, the Service and the National Park Service will continue a study to determine the extent of raptor predation on Kittlitz's murrelets in Icy Bay, southeast Alaska. This study will utilize radio telemetry and stable isotope analysis along with classical techniques to evaluate predation rates.

Indicate which State(s) (within the range of the species) provided information or comments on the species or latest species assessment:

Alaska

Indicate which State(s) did not provide any information or comment:

none

State Coordination:

Kittlitz's murrelet was selected as a featured species in Alaska's Comprehensive Wildlife Conservation Strategy (ADF&G 2006) based on: 1) its classification by NatureServe as imperiled; 2) the noticeable decline in abundance; 3) its rarity; 4) our identification of the species as a candidate for listing under the Endangered Species Act; 5) its endemism; 6) its seasonally restricted local range; 7) its sensitivity to environmental disturbance; and 8) its disjunctive distribution. The issues and concerns identified for Kittlitz's murrelets include habitat loss (i.e., receding glaciers), gillnet mortality, vessel disturbance, mining, climate change, and climate regime shifts. To date, two Kittlitz's murrelet studies have been funded through the State Wildlife Grant process.

We have collaborated with the Alaska Department of Fish and Game (ADF&G) on past research projects for Kittlitz's murrelet, and are continuing this coordination on current and future work.

In July 2004, the Service commenced a 3-year study of Kittlitz's murrelet annual and seasonal patterns of abundance within Kachemak Bay, funded in part through Alaska's State Wildlife Grant program (Kuletz et al. 2008).

In 2007, Alaska Department of Fish and Game gathered abundance data on Kittlitz's murrelets in Glacier Bay National Park in conjunction with a larger study of marbled murrelets. This study was funded through Alaska's State Wildlife Grant program.

In 2008, Alaska Department of Fish and Game initiated a study to assess bycatch of Kittlitz's murrelets in Alaskan gillnet fisheries. This study is supported with section 6 funds, and will be completed in 2011.

In 2009, Alaska Department of Fish and Game in cooperation with Audubon Alaska conducted a survey of Kittlitz's and marbled murrelets in Glacier Bay. This work will be completed in 2011.

Alaska Department of Fish and Game has contracted Bob Day, ABR Inc., to conduct a review of past population estimates of Kittlitz's murrelets and identify potential biases in methodology, design and analyses. The purpose of this review is to provide a framework for consistency and standardization in future survey efforts. This project was completed and we recently received a final report from the State which is currently being reviewed.

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Approval/Concurrence:

Lead Regions must obtain written concurrence from all other Regions within the range of the species before recommending changes, including elevations or removals from candidate status and listing priority changes;

the Regional Director must approve all such recommendations. The Director must concur on all resubmitted 12-month petition findings, additions or removal of species from candidate status, and listing priority changes.

Approve: 06/01/2011
Date

Concur: 10/07/2011
Date

Did not concur: ______________________ ______________
Date

Director's Remarks: